Perceptions of successful unlearning in hearing aid practioners

Julee H. Hafner
The Chicago School of Professional Psychology
wehaf2talk@gmail.com

Abstract

In patient care, maintaining skill competencies during technological advances requires effective knowledge changes processes. One method used consists of task repetition until errors are non-existent and successful demonstration of new learning is complete however, adjusting to numerous procedural changes may be difficult. Determining how to maximize change process during competency acquisition is essential. The strategy of how to change or "unlearn" previous actions and acquire new competencies successfully has been of interest. Because of the lack of a consistent definition of unlearning, a persistent problem remains. This study: (a) collected information about successful unlearning, and (b) demonstrated unlearning requirements for knowledge change occurrences in the hearing healthcare field. Study results: Survey of fifty hearing-aid professionals assessed their successful unlearning during instrumentation advances. Practioners' responses during instrument updating demonstrated three perceptions of successful unlearning- requiring previous knowledge base, awareness about the need for change, and possessing positive viewpoints about unlearning.

1. Introduction

For practioners, implementation of new technology or processes may result in the need for revisions of their current knowledge base and actions to correctly perform updated job functions. Researchers have investigated unlearning from diverse perspectives with continued disagreement about the differences between learning and unlearning.

Learning involves processing information into learned responses that later become habituated to proficiency, or a routinized knowledge base. Learning of this new knowledge base to successfully perform updated tasks without errors has become an important focus for healthcare practioners [1]. During knowledge change, work product errors may impact practioner competency and healthcare service delivery. The ability to maintain a competitive advantage during technological and process changes has been an ongoing problem in healthcare [1].

Learning strategies and other teaching methods assist in making needed modifications, but fail to focus on the difficulties during knowledge change. Some practioners may have difficulties in completing updated job functions, resulting in an incomplete unlearning process and stress. Determining what needs to be unlearned is critical to reduce errors and perform successfully [1].

Conforming to numerous procedural and technological changes of employees has been a previous focus, however not specifically in healthcare practioners. The process of successful knowledge use and change requires understanding of how updating in practioners occur [2], [3].

With healthcare practioners responsible for maintaining competency and providing error-free service, the strategy of how to successfully update processes or "unlearn" previous actions and maintain those new competencies has been of interest [4]. Unlearning, defined by some researchers, as the process of removing, discarding, or eliminating an action, procedure, or belief in favor of a new one [1], [2], [5]. There remains an ongoing confusion about factors that are involved in the unlearning process.

To acquire and internalize task competencies of any workers, specifically healthcare practioners, requires successful unlearning [1]. However, in order to make changes in knowledge, or unlearning, requires a previously acquired knowledge base. This learning involves a specific learned familiarity, or competency level [6]. Successful unlearning represents the recognition that current knowledge requires updating and actions to begin knowledge change should be initiated [4], [7], [8]. In addition, this process allows the individual to perform new competencies with ease and without error [6].

However, barriers to completion of the process may occur creating a return to previous competencies. This unique process may be categorized as incomplete or unsuccessful unlearning, whereby the knowledge change is stalled in some way. Without a specific accepted understanding of these differences between the complete and incomplete unlearning processes, how to successfully create knowledge change within healthcare practioners will remain unsolved.

With healthcare organizations requiring updated competencies constantly, the process to update previously learned knowledge needs further investigation [1], [2]. Undergoing knowledge change

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and developing knowledge competencies is an ongoing problem for all organizations, but are especially critical for healthcare organizations who impact human well-being [**6**]. Processes impacting complete unlearning may lead to procedural errors and a reduction in practioner competency, not to mention patient perception of reduced satisfaction.

To facilitate knowledge change when hearing practioners update their skills to use new technologies requires successful unlearning strategies [8]. Whether knowledge can essentially be discarded and completely replaced remains under investigation. How healthcare practioners' previously learned knowledge base becomes altered during knowledge updating also is not known.

2. Relevant Literature

Literature on the process of unlearning has been limited requiring tracing the concepts to its roots in the 1980's [8]. However, advances in the study of knowledge management and acquisition have developed a new interest in unlearning. Researchers have recently returned to unlearning due to its importance in maintaining competencies and knowledge management in many disciplines. Understanding unlearning can facilitate creation, alteration and maintenance of knowledge competencies for employees [2].

Learning of a new knowledge base to successfully perform tasks without errors has become an important focus for individuals within healthcare [6]. As technology advances, the ability to maintain competitive advantage becomes difficult for both organizations and employees.

Unlearning has been studied from a variety of theoretical frameworks. While there is agreement that knowledge or behavior requires unlearning, there is continued disagreement about how this process occurs [4], [1]. The confusion about unlearning characteristics lacks empirical agreement about process specifics. The term unlearning is present within many disciplines; however, there is a lack of consensus regarding a clear understanding of the process and usage of this term.

As knowledge changes continually, today's healthcare practioners are faced with the difficult task of keeping pace. Implementation of any new process may result in added difficulty to complete the change successfully. New job functions not acquired have the potential to increase work product errors, not to mention technological upset for the practioner [6]. Therefore, technological changes in healthcare create an ongoing need to unlearn old competencies. Without updating to maintain competency levels, practioners can expend additional time and energy increasing service delivery costs. Employee perceptions are noted to create upset when unlearning is unsuccessful, resulting in a decrease feelings of competency and leading to less patient satisfaction.

In practice, instruments used by healthcare practioners, specifically hearing professionals, are often upgraded with new versions or replaced with new technology to more closely support service delivery functions. Many of the users develop unconscious or rote behavior when working with new technology. These changes require that practioners and other users continually revise their mental models and processes in using new versions.

During transformational learning of a new competency, employees use previously acquired knowledge until new knowledge becomes available. To utilize newly acquired knowledge, a realization between old and emerging new skills must occur [4], [7]. The individual then produces the changes needed through additional knowledge processing and stabilization [7], [10]. Automatic actions, behaviors and "mental models" change through the process of "unlearning" [4], [7], [11].

Conflicts in individuals are noted when their current knowledge and environment factors have changed. In order to remain current to these changes, a process to remove old knowledge would be required. This remains different from learning. Both processes involve a matching between previous and new knowledge. Learning can take place on a simple level where individuals adjust and improve their behavior as in single loop learning [13]. Or, individuals may reflect on differences in their actions, beliefs, or mental models and choose to change knowledge as in double-loop learning [13]. However, some authors consider that using the term, unlearning to describe this type of reflection may be redundant. It is not reflection process that is the issue. Unlearning begins with the awareness of inconsistencies to the knowledge base contain outdated, faulty or ineffective knowledge that separates learning from unlearning. It also may involve emerging awareness to unconscious routines that require updating.

Defining unlearning as a process of discarding or eliminating knowledge may create the illusion that there is a completion of the process. True replacement would have occurred where the previous knowledge could be removed from consciousness. However, knowledge may lodge in the unconscious- distributed within the neural network and individuals may be able to retrieve it later for a variety of reasons.

Whether the individual has control over knowledge change or this process is an unconscious activity remains unaccounted for during unlearning. The present knowledge base and individual learning style impacts learning competency, but it may also impact unlearning.

When individual unlearning is not successful, and employees remain in their position, errors can occur, thus creating increased confusion and tension in the individual [12]. Errors may consist of slow, incorrect,

or inconsistent actions. Causal factors of errors may include interruptions in learning behavior or faulty processes during change [13], [14]. Decreased productivity, reduced quality, and additional costs may be unintended consequences of these errors resulting from organizational change [15].

Unlearning is the process of replacement or disuse of knowledge, action, or procedure substituting new knowledge when appropriate [16]. Through unlearning, previously learned knowledge or procedures are modified by adding emerging skills with new knowledge, thus completing the learning process [17].

The use of unlearning as part of the process of gaining new knowledge involves total removal of old knowledge [8]. Knowledge acquisition and modification has been previously speculated to involve "replacement" of prior knowledge [18]. Newstrom (1983) posited individuals begin with a "clean slate" before adding information [19]. This suggests that the brain actually erases unneeded information [12]. Clark (2010) discounted this concept, as faulty suggesting knowledge cannot be added to infinitely. This would suggest an ever-expanding brain that stores and processes vast amounts of data [12]. Or, this process may require a reduction of acquisition as there needs to be "space" to place the new knowledge [20**,** p. 59]

However, practioners require the realization that previous knowledge is unreliable and they need to stop using it [4]. Nystrom & Starbuck suggest that the idea that an individual should "eliminate preexisting knowledge or habits that would otherwise represent formidable barriers to new learning" was suggested, but has not been empirically established [12, p. 36]. Often viewed as a complex cognitive process, unlearning may be an unrecognized and unused, yet important, part of the learning cycle. However, practioners are responsible to unlearn previously used knowledge to make changes in knowledge and actions as technology is advanced [4]. Recently acquired knowledge often remains untested by the individual [21], [4]. When knowledge is absorbed it becomes part of the awareness of the individual, but it is not necessarily used [17]. Acquiring and changing competency from the previous learned knowledge base can be difficult for healthcare practioners resulting in confusions and technological upset while knowledge is tested [22], [23], [24].

According to Rushmer and Davies, knowledge change within the healthcare environment may involve three types of unlearning [1]. R*outine unlearning*, involves simple change of a previously learned task to an updated one; *wiping*, involving slow transitional changes to the use of new methods; and *deep unlearning* involving transformational change where completely different processes are used [1]. Each unlearning level adds the rate for the actions and how they are initiated [1].

Healthcare organizations and practioners must change their actions quickly and effectively to produce new outcomes. Practioners need to understand the components of successful unlearning in order to focus on updating skill competencies and practices. Completely changing this knowledge base involves the successful alteration and use of this new knowledge. However, researchers are uncertain as to the process involved [8].

To reduce this impact, systemic change through individual unlearning is necessary [1]. The concern about being able to change information continually, the disposition of old information, and the ability to override previous learning when needed are difficult for practioners. Due to the need for consistent updating, unlearning may play an important role in successful practioner knowledge change during technological advances.

Acquiring and changing competency from the previous learned knowledge base can be difficult for healthcare practioners creating upset [22], [23], [24]. Some authors have suggested that the learning process in an individual is important to the expression of knowledge and transmission of that knowledge, thus resulting in competency with other organizational individuals [25]. It is these knowledge processes that come from experiences and actions that comprise the knowledge base.

With continual emphasis on unlearning skills to update the old, the process is continual. Practioners involved in skill changes must be able to discard their current competencies and mental models in favor of the new knowledge [5]. However, consistent behavioral repetition within a workplace environment is required for successful service delivery daily actions [26], [10]. When unlearning is unsuccessful, errors in actions may result. During updating processes where actions are already in a state of flux, such as in updating technology, understanding unlearning may prove useful, especially deriving frameworks from learning theories.

Bloom's taxonomy provides an additional study foundation and presents three domains that relate to knowledge acquisition: the affective, the psychomotor, and the cognitive domain [27]. The affective domain focuses on the way the learner responds to learning. The psychomotor domain focuses on the actions, accuracy, and rate the learner performs the task [27]. Learning of factual knowledge and abilities acquired through recall are present involve the cognitive domain [27]. The difference with unlearning involves mental skill changes with a previously learned knowledge base. How the brain changes old unconscious behaviors, specifically in the area of retrieval and use as well as storage and disuse of into new automatic behaviors, may be a function of the unlearning process. With continual emphasis on unlearning skills to update the old, the process is continual. However, consistency in repetition, knowledge storage and retrieval systems need to be in place, for complete unlearning to occur [10].

Continuing confusion regarding characteristics of unlearning lacks empirical agreement consisting of anecdotal evidence about the process. A review of the literature may consist of many features and process dynamics [28], [6]**.** Unlearning may be an additional factor to consider during successful knowledge change. Complete unlearning occurs when updated knowledge is incorporated successfully into practioner patient care routines and medical errors eliminated [6]**.** Although unlearning terminology is now considered multidisciplinary, lack of a consistent definition remains without consensus. Unlearning is a knowledge change process; however, empirical identification of specific factors contributing to completion of the process is unknown. The following investigation will address successful completion of practioner knowledge change.

3. Research Method

Healthcare practioners require accuracy and current competencies to complete service delivery. To stay competent, service providers must maintain a previous knowledge base as a routine of practice. In this study, unlearning was defined as updating through the replacement of prior knowledge due to the realization that current knowledge has become obsolete.

A survey created and based on a previously rigorously validated tool collected perceptions of unlearning from hearing aid practioners [2]. Modification of validated survey questions were finalized to select items specifically related to individual unlearning behavior [2]. For this study, unrelated unlearning in an organization were removed. This yielded a 40-question 5-point Likert scale survey including demographic data. The following table represents the selected survey questions for analysis in this study in Table 1.

PROMPT	STATEMENT
Question 1:	"My level of experience made it easier for me to make the change".
Question 2:	"I was comfortable with the old way of doing things".
Question 3:	"I had a positive overall view of the new way".
Question 4:	"My colleagues were positive overall about the new way".
Question 5:	"I understood why the new way was needed".
Question 6:	"I thought the old way was quite acceptable and didn't need to change".
Question 7:	"I feel that the new way has been a successful change".

Table 1: Selected unlearning survey questions

Fifty (50) independent healthcare practioners providing hearing healthcare services, specifically hearing aid fitters, were surveyed to assess their knowledge change in light of technological advances in their use of updated hearing aid instruments. Practioners were convenience sampled from a tristate area of the United States. Practioners represented the population of hearing healthcare knowledge workers consisting of 34 (68%) males and 16 (32%) females with ages ranging from 21-70+ years old. Other demographics included practioners having high school education 16 (32%), college 32 (64%), and graduate education 12 (24%).

The majority of hearing aid fitters (72%) were current practioners with a clinical background and state license. Each hearing practioner experienced a knowledge base change consisting of a change in fitting of an older hearing aid model to a technologically superior one. The process of fitting a hearing instrument to a specific client was the knowledge base surveyed. The participants could have continued current procedures with hearing-aid fitting without potential for errors. This would present as a routinized knowledge base. Technology created the need for unlearning through updating hearing aid instrument models. Practioners with a previous knowledge base of over 5 years represented 64% of the respondents. Other respondents used their previous knowledge base for different periods of time and were evenly distributed with each representing 8% of the respondents: 2-5 years, 2 years, 1 year and under 6 months.

Each practioner had experience in aid fitting. A technological advance in instrumentation, which required updating fitting knowledge consisting of new technology, technique, or features was required. Hearing aid fitters were making these knowledge changes based on availability of new technological advances in hearing aid devices, as the previous knowledge had become obsolete, not based on perception of authority or other factors.

Examples of various instruments used by hearing practioners were numerous, but represented previous practioner knowledge base. Hearing instrument models that were updated included, Miracle-Ear TM Mirage (2011) to GENIUSTM technology (2015), ReSound TM the LiNX (2014) to the LiNX2 (2015). Other instrument updating included new technology where no prior model was comparable. These models included examples such as, Starkey model Z Series, Widex's the DREAM series, or Phonak's Venture (Models- 90, 70, 50, 30) (2015).

Hearing aid fitters' perceptions about unlearning were investigated through survey methodology based on a previous mixed methodology research study of unlearning in organizations and individuals using a validated questionnaire [2].

The research question this study investigates is,

Do technological advances in instrumentation inspire new perceptual factors needed for successful unlearning in hearing-aid practioners?

4. Results

Practioner perceptions about unlearning processes during updating were collected via questionnaire survey. The data were tabulated according to concepts related to unlearning, specifically examining whether knowledge base, views regarding knowledge change and awareness of need for change were present in successful unlearning in these practioners.

Analysis of perceptions needed for successful unlearning collected from practioner interaction with updated hearing aid instruments. The result of this analysis is in Table 2. Analysis of the responses used open coding. Two phases were used to categorize data. First, open coding identified areas of focus and helped to categorize each response of occurrence. Occurrences were categorized perceptions and views about the unlearning process. In the first phase, two independent coders sorted response data obtained from survey questions.

Perceptions of individual unlearners were selected as these hearing aid fitters were making changes based on availability of new advances, not authority or other factors. The current knowledge had become obsolete and the processes used required change.

The data was reviewed for new perceptual factors of unlearning. "Insights do not just occur haphazardly; rather, they happen to prepared minds during interplay with the data' [29**,** p.47]**.** Theoretical sensitivity allowed the researcher to have insight into the collected data per the selected methodology [29]. The data was re-examined for additional subcategories of successful unlearning. Three categories were selected for focus and were related to prior experience. Knowledge base, their awareness of the change and their ability to accept change through a positive viewpoint were analyzed.

In the second phase, categorization of perception subcategories present in hearing practioner unlearning answered the research question. Category condensation provided a more accurate picture of the results provided by the respondents. Their responses provided information related to unlearning of a knowledge base, viewpoints about change, and change awareness when advanced in technology in hearing instrument technology occurs. Table 2 presents the results of the data collection.

RESULTS	**AGREE**	**NEUTRAL**	**DISAGREE**
PRIOR			
Question 1	36	10	4
Question 2	31	11	8
Question 3	33	12	5
Question 4	23	16	11
Question 5	40	7	3
Question 6	10	10	30
AFTER			
Question 7	44	4	1

Table 2: Summary Table survey results

5. Discussion

Perceptions needed for successful unlearning were noted by practioners to include a prior knowledge base, awareness of need for the change and a positive perception for change. The survey questions provided the categories for unlearning requirements. The survey questions 1- 6 were grouped to examine perceptions prior to need for unlearning. These similar perceptions represented practioner perceptions prior to change of hearing aid instrumentation.

Question 1: "*My level of experience made it easier for me to make the change";* Question 2: "*I was comfortable with the old way of doing things".* Question 1 reveals the need for prior level of competency as a practioner. Responses that agreed with the statement represented 72% of the sample. In question 2, practioner comfort about prior knowledge and represented 62% of the sample. These two responses demonstrated the need for a prior knowledge base in the hearing aid practioner. The previous learning made the practioner feel competent with performing routine service delivery. The healthcare practice of hearing aid fitting was successful.

Question 3: "*I had a positive overall view of the new way";* Question 4: "*My colleagues were positive overall about the new way.* Responses that agreed with the question 3 responded affirmatively and represented 68% of the sample. Agreed responses on question 4 about colleagues represented 48% of the sample. These responses suggest that when the practioner was positive about the need for unlearning, the process was successful. Colleagues that were also positive provided reinforcement and support for unlearning during updating to advanced instrumentation.

Question 5: "*I understood why the new way was needed";* Question 6: "*I thought the old way was quite acceptable and didn't need to change".* Responses that agreed with the statement on question 5 represented 90% of the sample. Question 6 revealed that 60% that disagreed with this statement, suggesting that practioners were aware of the need for change. In both these responses, practioners became aware for the need for unlearning of previous competencies, which

may initiate the unlearning process. The practioners disagreed that the "old" methods of service delivery were correct and did not required updating. Their awareness that competency was in error may be required to initiate unlearning processes.

The final response collected information about participants views about the completion of a successful unlearning process. *Question 7: "I feel that the new way has been a successful change"*. The results of this data suggested that practioner unlearning was successful when knowledge base, awareness and a positive view towards updating were present. Reponses were tabulated; Positive responses 44 (88%), Neutral, 4 responses (.08%) and Negative, 1 response (.02). After updating occurred, the practioners responses demonstrated their agreement about successful knowledge change included the three factors of, knowledge base, viewpoints about change, and change awareness. The results for the subcategory responses are listed below in Figure 1.

There appears to be a connection between successfully unlearned techniques, especially during updating technology as in periods of transformational advances. When the individual allows the new knowledge to be processed, and awareness of the inconsistencies occur. From this point in time, the individual begins the knowledge comparison process with recognition of the gap between previous and current knowledge. This awareness begins the unlearning process where previous knowledge base and the updated information are compared constantly to determine the faulty information. When there is a positive overall perception about the change, practioners are supported and technological change occurs with ease. When the updating process is completed, practioners have produced successful unlearning.

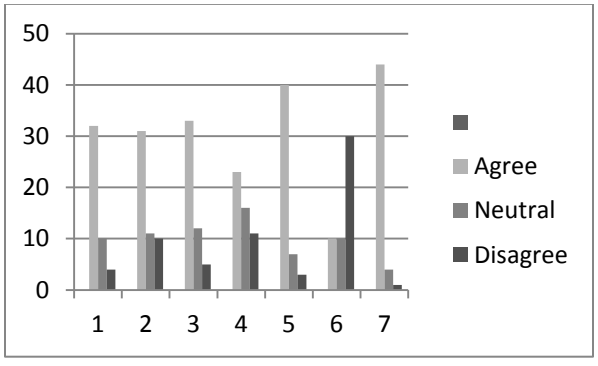

Figure 1: Perceptions of practioner responses to Question 1-7 related to successful unlearning

Surveyed practioners, specifically hearing aid fitters, responded about their successful knowledge change during updating to new hearing aid instruments. A realization between old and emerging new skills must occur to allow the individual to update their current knowledge base. When practioners attempt to update knowledge, comparison and awareness of the inconsistencies occur. The individual recognizes the gap between previous and current knowledge.

Practioners' responses during instrument updating demonstrated three perceptions of successful unlearning- requiring previous knowledge base, awareness about the need for change, and possessing positive viewpoints about unlearning. In this study, the practioners realized their previous knowledge base required updating due to recent advances in technology. Practioners became aware of outdated practices with technological advances. This presented itself as awareness of the need for change. The fact that practioners were positive about the change may have created an environment of technological ease making updating easier. The added perceptions of colleagues remaining positive about changing instrumentation further supported their unlearning success. This study gives credence and supports the idea that perceptions of successful unlearning includes three factors, requiring a previous knowledge base to work as a foundation for learning change, awareness for the need for change, and possessing positive viewpoints about the need for knowledge change.

Practioner responses in this study provided additional information related to successful unlearning from a routinized knowledge base in a new population of hearing healthcare professionals when an advance in hearing instrument technology occurs.

6. Need for further research

This research study adds to the current practical understanding of the unlearning process that remains not completely understood. Changing knowledge requires healthcare practioners to alter their knowledge base in favor of new competencies for patient safety and efficiency. With additional results from ongoing study, an elimination of healthcare practioner errors improving patient safety. This research provided additional understanding of the complex process of unlearning and the factors requires for a successful knowledge change process when there is awareness of obsolete knowledge.

Healthcare organizations may benefit from new investigations of unlearning. With the vast amount of knowledge need to remain a competent healthcare practioner, knowledge base requires continued updating to new competencies. The complexities of the process of unlearning continue be an excellent focus for continued research.

Future research should complete additional studies to characterize and quantify what happens to the obsolete knowledge. The focus of additional study can also involve various methodological constructs to

characterize knowledge updating such as in individual experiences, perceptions, and influencers.

Because adults create and use a variety of types of knowledge, change processes become critical to successful operations. Facilitating knowledge change successfully and avoiding erred or obsolete knowledge is important to individuals that need to change existing knowledge base for new competency requirements.

With better understanding of a successful knowledge change process, practioners can avoid unsuccessful unlearning. How unlearning may explain what happens to unused knowledge may benefit individuals and organizations. This understanding will impact the knowledge change processes in workplace and assist in developing organizational effectiveness.

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